CLAIMS

What is claimed is:

1. A composition for stimulating an immune response to HER-2 protein, said composition comprising a HER-2 B cell epitope, said HER-2 B cell epitope comprising a sequence selected from the group consisting of:

TGTDMKLRLPASPETHLDM, SEQ ID NO. 1, or a functional equivalent thereof;

AVLDNGDPLNNTTPVTGASPGG, SEQ ID NO. 2, or a functional equivalent thereof;

LWKDIFHKNNQLALTLIDTNRS, SEQ ID NO. 3, or a functional equivalent thereof;

TLIDTNRSRACHPCSPMCKGSRCWGESSEDCQSLT, SEQ ID NO. 4, or a functional equivalent thereof;

ALVTYNTDTFESMPNPEGRYT, SEQ ID NO. 5, or a functional equivalent thereof;

PLHNQEVTAEDGTQRAEKCSKPCA, SEQ ID NO. 6, or a functional equivalent thereof;

PESFDGDPASNTAPLQPE, SEQ ID NO. 7, or a functional equivalent thereof;

LYISAWPDSLPDLSVFQNLQ, SEQ ID NO. 8, or a functional equivalent thereof;

LFRNPHQALLHTANRPEDE, SEQ ID NO. 9, or a functional equivalent thereof;

CLPCHPECQPQNGSVTCFGPEADQCVACAHYKDP, SEQ ID NO. 10, or a functional equivalent thereof;

KPDLSYMPIWKFPDEEGA, SEQ ID NO. 11, or a functional equivalent thereof; and

INGTHSCVDLDDKGCPAEQRAS, SEQ ID NO. 12, or a functional equivalent thereof.

2. The composition of claim 1 wherein said composition is a chimeric peptide and further comprises:

a) a T helper (Th) epitope; and

b) a linker joining said HER-B cell epitope to said Th epitope.

3. The composition of claim 2 wherein the HER-2 B cell epitope is from 15 to 50 amino acids in length, wherein the Th epitope is a promiscuous Th epitope of from 14 to 22 amino acids in length, and wherein said linker is from 1 to 15 amino acids in length.

4. The composition of claim 2 wherein the Th epitope comprises a sequence selected from the group consisting of:

N-S-V-D-D-A-L-I-N-S-T-I-Y-S-Y-F-P-S-V, SEQ. ID. NO. 13, or a functional equivalent thereof;

P-G-I-N-G-K-A-I-H-L-V-N-N-Q-S-S-E, SEQ ID NO. 14, or a functional equivalent thereof;

Q-Y-I-K-A-N-S-K-F-I-G-I-T-E-L, SEQ ID NO. 15, or a functional equivalent thereof;

F-N-N-F-T-V-S-F-W-L-R-V-P-K-V-S-A-S-H-L-E, SEQ ID NO. 16, or a functional equivalent thereof;

L-S-E-I-K-G-V-I-V-H-R-L-E-G-V, SEQ ID NO. 17, or a functional equivalent thereof;

F-F-L-L-T-R-I-L-T-I-P-Q-S-L-N, SEQ ID NO. 18, or a functional equivalent thereof; and

T-C-G-V-G-V-R-V-R-S-R-V-N-A-A-N-K-K-P-E, SEQ ID NO. 19, or a functional equivalent thereof.

5. The composition of claim 2 wherein the linker comprises the sequence GPSL, SEQ ID NO. 20.

6. The composition of claim 1 wherein said composition is a multivalent peptide and comprises 2 or more HER-2 B cell epitopes, a Th cell epitope, and a template; wherein the HER-2 B cell epitopes and the Th cell epitope are attached to the template.

7. The composition of claim 6 wherein said template is a core β sheet.

8. The composition of claim 7 wherein the core β sheet comprises two strands of alternating leucine and lysine residues connected by a linker.

9. A composition for stimulating an immune response to HER-2 protein, said composition comprising a HER-2 CTL epitope, said HER-2 CTL epitope comprising a sequence selected from the group consisting of:

ILWKDIFHK, SEQ ID. NO. 21; or a functional equivalent thereof;

ILKETELRK, SEQ ID. NO. 22; or a functional equivalent thereof;

VLRENTSPK, SEQ ID. NO. 23; or a functional equivalent thereof;

AARPAGATL, SEQ ID. NO. 24; or a functional equivalent thereof;
LPASPETHL, SEQ ID. NO. 25; or a functional equivalent thereof;
LPTHDPSPL, SEQ ID. NO. 26; or a functional equivalent thereof;
CRWGLLLAL, SEQ ID. NO. 27; or a functional equivalent thereof;
RRFTHQSDV, SEQ ID. NO. 28; or a functional equivalent thereof;
GRILHNGAY, SEQ ID. NO. 29; or a functional equivalent thereof;
TYLPTNASL, SEQ ID. NO. 30; or a functional equivalent thereof;
EYVNARHCL, SEQ ID. NO. 31; or a functional equivalent thereof;
AYSLTLQGL, SEQ ID. NO. 32; or a functional equivalent thereof;
ALCRWGLLL, SEQ ID. NO. 33; or a functional equivalent thereof;
HLYQGCQV, SEQ ID. NO. 34; or a functional equivalent thereof;
QLRSLTEIL, SEQ ID. NO. 35, or a functional equivalent thereof;
ILHNGAYSL, SEQ ID. NO. 36; or a functional equivalent thereof;
ILLVVVLGV, SEQ ID. NO. 37; or a functional equivalent thereof;
DLTSTVQLV, SEQ ID. NO. 38; or a functional equivalent thereof;
VLVKSPNHV, SEQ ID. NO. 39; or a functional equivalent thereof;
KIFGSLAFL, SEQ ID. NO. 40; or a functional equivalent thereof; and
IISAVVGIL, SEQ ID. NO. 41; or a functional equivalent thereof.

10. The composition of claim 9 wherein said composition is a chimeric peptide and further comprises

a) a T helper (Th) epitope; and

b) a linker joining said HER-2 CTL epitope to said Th epitope.

11. The composition of claim 9 wherein the composition comprises a HER-2 CTL eptiope from class HLA-A3, a HER-2 CTL epitope from class HLA-B7, a HER-2 CTL epitope from class HLA-A2, and a HER-2 CTL epitope from class HLA-B27.

12. The composition of claim 9 wherein the composition is a linear peptide which comprises

(a) a first unit comprising 4 or more HER-2 CL2 epitopes linked to each other by a linker which comprises from 1 to 6 amino acids, and

(b) a second unit which is a promiscuous Th epitope of from 14 to 22 amino acids in length, wherein said second unit is linked to the amino terminus or the carboxy terminus of said first unit by said linker.

13. The composition of claim 10 wherein the Th epitope comprises a sequence selected from the group consisting of:

N-S-V-D-D-A-L-I-N-S-T-I-Y-S-Y-F-P-S-V , SEQ. ID. NO. 13, or a functional equivalent thereof;

P-G-I-N-G-K-A-I-H-L-V-N-N-Q-S-S-E, SEQ ID NO. 14, or a functional equivalent thereof;

Q-Y-I-K-A-N-S-K-F-I-G-I-T-E-L, SEQ ID NO. 15, or a functional equivalent thereof;

F-N-N-F-T-V-S-F-W-L-R-V-P-K-V-S-A-S-H-L-E, SEQ ID NO. 16, or a functional equivalent thereof;

L-S-E-I-K-G-V-I-V-H-R-L-E-G-V, SEQ ID NO. 17, or a functional equivalent thereof;

F-F-L-L-T-R-I-L-T-I-P-Q-S-L-N, SEQ ID NO. 18, , or a functional equivalent thereof; and

T-C-G-V-G-V-R-V-R-S-R-V-N-A-A-N-K-K-P-E, SEQ ID NO. 19, or a functional equivalent thereof.

14. The composition of claim 10 wherein the linker comprises the sequence GPSL, SEQ ID NO. 20.

15. The composition of claim 12 wherein the linker comprises a proteolytic site.

16. The composition of claim 12 wherein the linker comprises two adjacent basic residues.

17. The composition of claim 12 wherein the composition is associated with a biodegradeable microsphere or nanosphere.

18. The composition of claim 9 wherein said composition is a multivalent peptide and comprises 2 or more HER-2 CTL cell epitopes, a Th cell epitope, and a template; wherein the HER-2 CTL epitopes and the Th cell epitope are attached to the template.

19. The composition of claim 18 wherein said template is a core β sheet.

20. The composition of claim 19 wherein the core β sheet comprises two strands of alternating leucine and lysine residues connected by a linker.

21. A method of stimulating an immune response in a subject comprising administering to said subject a composition selected from the group consisting of the composition of claim 1, the composition of claim 9, and a polypeptide which comprises the composition of claim 1 and the composition of claim 9.

22. The method of claim 18 wherein the composition is a multivalent peptide which comprises 2 or more HER-2 B cell epitopes, a Th cell epitope, and a template, wherein said HER-2 B cell epitopes and said Th cell epitope are attached to said template.

23. The method of claim 20 wherein the composition is a multivalent peptide which comprises 2 or more HER-2 CTL epitopes, a Th cell epitope, and a template, wherein said HER-2 CTL epitopes and said Th cell epitope are attached to said template.

24. The method of claim 20 wherein the composition is a multivalent peptide which comprises a HER-2 B cell epitope, a HER-2 CTL epitope, a Th cell epitope, and a template, wherein said HER-2 B cell epitope, said HER-2 CTL epitope and said Th cell epitope are attached to said template.

25. A method of treating cancer in a subject comprising administering a pharmaceutical composition to said subject, said pharmaceutical composition comprising:

the composition of claim 1 or the composition of claim 9, and

a pharmaceutically acceptable vehicle.

26. The method of claim 25 wherein the subject is a human and has one of the following cancers or a predisposition to one of the following cancers: breast cancer, ovarian cancer, lung cancer, prostate cancer, and colon cancer.

27. The method of claim 25 wherein the vehicle is biodegradeable and is selected from the group consisting of an emulsion comprising a pharmaceutically acceptable oil/water emulsion and a biodegradeable microsphere or nanosphere comprising a polylactide-polyglycolic acid polymer.

28. The method of claim 27 wherein the oil is squalene or squalane.

29. The method of claim 27 wherein the microsphere is from 0.1 to 50 nanometers in diameter and comprises poly (D, l lactide-co-glycide).

30. An isolated polynucleotide which encodes a chimeric peptide selected from the group consisting of the chimeric peptide of claim 2, the chimeric peptide of claim 10, and the chimeric peptide of claim 12.

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